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### REMARKS

As an initial matter, Applicant asserts the adequacy of the Japanese Language Declaration filed on January 11, 2002 in the present case. The Examiner has objected to this Declaration for failing to meet multiple formalities required by the United States Patent and Trademark Office (USPTO), (Office Action, dated October 9, 2003, page 2, lines 1-13). However, the Declaration is an official USPTO form, and its boiler plate language is believed to meet the formal requirements of the USPTO. There is no assertion that the form has been incorrectly completed. Rather, the Examiner objects to this official form as failing to meet the formal requirements of the Patent Office.

On October 29, 2003, W. Scott Ashton (Reg. No. 47,395) contacted Mr. Roy King at 703-308-1146 to discuss the Declaration. Mr. King is a supervisor for Examiner Ip. Mr. King confirmed that the Japanese Language Declaration filed on January 11, 2002, in the present case met all formal requirements of the USPTO. Therefore, Applicant believes the Examiner's objection to the Declaration has been overruled.

Applicant also gratefully acknowledges the Examiner's Interview held on December 16, 2003 (See Interview Summary, dated December 16, 2003). During this interview, both Examiner Ip and Mr. Joerg-Uwe Szipl, Applicant's representative, agreed that U.S. Patent No. 5,582,281 to Nakashima et al. represented the closest prior art of record.

### The Invention

The present invention pertains broadly to free-cutting copper alloys, having low lead contents, good machinability and corrosion resistance, such as would be used in manufacturing water faucets, water supply/drainage metal fittings and valves, and other similar components of water supply lines. A first embodiment of the present invention

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provides a free-cutting copper alloy, consisting essentially of (a) 69 to 79 percent, by weight, of copper; (b) 2.0 to 4.0 percent, by weight, of silicon; (c) 0.02 to 0.4 percent, by weight, of lead; and (d) a remaining percentage, by weight, of zinc, wherein the percent by weight of copper and silicon in the copper alloy satisfy the relationship  $60 \leq X - 3Y \leq 70$ , wherein X is the percent, by weight, of copper, and Y is the percent, by weight, of silicon; and the copper alloy has a metal construction comprising multiple phases integrated to form a composite phase, wherein the composite phase is an  $\alpha$  phase matrix having a total phase area comprising not more than 5% of a  $\beta$  phase, and 5-70% of the total phase area is provided by at least one phase selected from the group consisting of a  $\gamma$  phase, a  $\kappa$  phase, and a  $\mu$  phase.

Various other free-cutting copper alloy embodiments are recited in the remaining independent and dependant claims. However, all of the free-cutting copper alloy embodiments in accordance with the present invention have the advantage of lower Pb contents than those of the prior art while maintaining industrially acceptable machinability and corrosion resistance characteristics. The free-cutting copper alloys in accordance with the present invention are all endowed with this advantage because the metal phase construction is formed so that the total phase area comprises not more than 5% of a  $\beta$  phase. In other words, to maintain industrially acceptable machinability and corrosion resistance properties despite the relatively low lead contents, the Cu-Zn(Pb) alloys made in accordance with the present invention all have a percentage of  $\beta$  phase that is kept within the critical range of not more than 5% of the total phase area. Cu-Zn(Pb) alloys made in accordance with the present invention also include some component of at least one of a  $\gamma$  phase, a  $\kappa$  phase, or a  $\mu$  phase.

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**The Rejection**

Claims 1-14 stand rejected under 35 U.S.C. § 103(a) as unpatentable over any one of the following: (a) JP 62-297429 (hereafter, "JP'429"), (b) JP 03-068733 (hereafter, "JP'733"), (c) U.S. Patent 5,942,056 to Singh (hereafter, the "Singh Patent"), (d) WO 9810105 (hereafter, "WO'105"), (e) JP 62-274036 (hereafter, "JP'036"), and (f) U.S. Patent 5,582,281 to Nakashima et al. (hereafter, the "Nakashima Patent").

Applicant respectfully traverses the rejection and requests reconsideration of the present application for the following reasons.

**Applicant's Arguments**

As acknowledged by the Examiner (Office Action, dated October 9, 2003, page 2, lines 15-22), to establish an obviousness rejection under 35 U.S.C. § 103, the examiner must (1) determine the scope and content of the prior art; (2) ascertain the differences between the prior art and the claimed invention; (3) resolve the level of ordinary skill in the art; and (4) determine the effect on patentability of secondary considerations that are relevant indicia of obviousness or nonobviousness. 148 U.S.P.Q. 459, 467 (1966). In the present case, first the scope and content of the prior art will be reviewed and the adequacy of the obviousness rejection is challenged. Second, the Examiner's obviousness rejection is additionally rebutted with objective evidence of nonobviousness provided in the Declaration of Keiichiro Oishi, filed concurrently herewith (hereafter, the "Oishi Decl.").

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**Scope and Content of the Prior Art**

**The Nakashima Patent:** the closest prior art

The Nakashima Patent teaches a "method of connecting a sliding ring member to a synchronizer ring," which includes the disclosure of a wear-resistant copper alloy containing 22-45 wt % of Zn, 0.1 to 15 wt % of at least one kind of metal element such as Pb, and a remaining amount of copper and impurities (See Nakashima, Abstract). It is also required that these wear-resistant copper alloys have a metal phase matrix that is either an  $\alpha+\beta$  matrix, a solely  $\beta$  matrix, or a  $\beta+\gamma$  matrix (See Nakashima, Abstract). Another required feature of these copper alloys is that they are wear-resistant and have a Hardness Rockwell B value of more than 80 (See Nakashima, Abstract). Those skilled in the art would instantly recognize that copper alloys made in accordance with the teachings of the Nakashima Patent are hard, rigid metals with poor machinability and unsuited for the manufacture of water faucets, water supply/drainage metal fittings and valves, and other similar components of water supply lines.

While Applicant and the Examiner agree that the copper alloys taught by Nakashima represent the closest prior art (See Examiner's Interview Summary, dated December 16, 2003), there are major differences between the copper alloys taught by Nakashima and the Cu-Zn(Pb) alloys of the present invention.

First, while Nakashima teaches generally that there must be at least wt 22-45 % of Zn in the alloy, the only specific example of a Cu-Zn(Pb) alloy (i.e., Nakashima, Example D in Table 1) contains 38% by weight of Zn, which means less than 65 wt % of Cu. Consequently, the Nakashima Patent does not explicitly teach, or even suggest, a free-cutting Cu-Zn(Pb) alloy having "69 to 79 percent, by weight, of copper" as recited in claims 1-14 of the present invention.

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Second, the Nakashima Patent teaches the desirability of predominately  $\beta$  phase metal constructions (i.e.,  $\alpha+\beta$  matrix, a solely  $\beta$  matrix, or a  $\beta+\gamma$  matrix). On the other hand, the present invention endeavors to "limit the amount of  $\beta$  phase in the  $\alpha$  matrix of the metal construction" because "if the copper alloy has less than about 30%  $\alpha$  phase...the copper alloy is not cold workable and can not be further processed by cutting in any practical manner" (See present specification, page 37, lines 2-9 and lines 24-25). In other words, the goals of the present invention and the Nakashima Patent are diametrically opposed. Clearly, the Nakashima Patent teaches away from a free-cutting copper alloy in accordance with the present invention and cannot teach, or suggest, a metal phase construction comprising "not more than 5% of a  $\beta$  phase" and "5-70% of the total phase area is provided by at least one phase selected from the group consisting of a  $\gamma$  phase, a  $\kappa$  phase, and a  $\mu$  phase" as recited in claims 1-14 of the present invention.

Table 1 of the Nakashima Patent lists only one Cu-Zn(Pb) alloy, Example D. This alloy is characterized as having solely a  $\beta$  phase matrix. The Oishi Decl., Comparative Sample No. 4 of Table I on page 19, and Exhibit A, unequivocally confirm that Example D of the Nakashima Patent has a metal phase construction consisting of only a  $\beta$  phase! Plainly, the Nakashima Patent does not teach, and cannot even suggest, the subject matter of claims 1-14 of the present invention because it teaches metal alloys having too much Zn, not enough Cu, and excessive amounts of  $\beta$  phase in the matrix construction.

#### The JP'429 Document

JP'429 teaches a "copper alloy having excellent corrosion resistance" that is usable for mechanical parts, hydraulic parts and valves (See JP'429, Abstract). However, the alloys

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taught by JP'429 must include Cu, Zn, Sn, P, Mn and Si as indicated by Samples 7-23 in Table 1 of the reference. Consequently, the JP'429 Document cannot teach, or even suggest, the composition of the alloys recited in claims 1-11 because the "consisting essentially of" language of these claims limits their scope to the specified ingredients and those additional ingredients that do not materially affect the basic and novel characteristics of the composition. In re Herz, 190 U.S.P.Q. 461, 463 (C.C.P.A. 1976).

In the present case, none of claims 1-11 recite tin as an ingredient. As shown in Table 9 of the instant application, and as explained by Mr. Oishi in paragraphs 31 to 33 of the attached Oishi Decl., it is clear the addition of tin to the Cu-Zn(Pb) metal alloys recited in claims 1-11 would be expected to materially diminish the basic and novel Charpy Impact Value characteristics (i.e., the impact resistance) of these invention metal alloys. As described in paragraph [0075] of the specification of the present application, this adverse affect on impact resistance is seen when as little as about 1% Sn, by weight, is added to the Cu-Zn(Pb) compositions. In view of these facts, the "consisting essentially of" scope of claims 1-11 should be interpreted to exclude tin because the presence of this element is expected to materially affect the basic and novel characteristics of these claimed compositions.

Another deficiency of JP'429 is that the amount of lead in its alloys is more than 1% in order to improve machinability (See JP'429, Examples 7 to 23 of Table 1). Metal alloys containing 1% or more of Pb leach lead and are harmful to humans. JP'429 teaches the

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desirability of adding lead in excess of 1% by weight, and actually teaches away from an alloy composition limited to "0.02 to 0.4%, by weight, of lead" as recited in claims 1-14 of the present invention.

Another deficiency of JP'429 is that it does not address the critical nature of the metal phase construction recited in claims 1-14. Specifically, each of claims 1-14 recite that the total phase area comprises "not more than 5% of a  $\beta$  phase." The requirement that there be "not more than 5% of a  $\beta$  phase" is a critical limitation of the metal phase construction of the alloys of the present invention, as supported by the attached Oishi Decl. As shown by the experimental data compiled in Table I of the Oishi Decl., the presence of  $\beta$  phase is independently related to both the amount of copper and zinc in the metal composition and the hot extrusion temperature of the Cu-Zn(Pb) alloys of the present invention. Lowering the amount of Cu while raising the amount of Zn may cause an excess amount of  $\beta$  phase to appear as suggested by Comparative Sample No. 7 of the Oishi Decl.. Likewise, raising the hot extrusion temperature to about 800°C can create an excessive amount of  $\beta$  phase as well.

To emphasize, JP'429 does not teach, or even suggest, that the total phase area comprises "not more than 5% of a  $\beta$  phase" as recited in claims 1-14. In fact, JP'429 is completely silent regarding metal phase construction; therefore, this reference also cannot teach, or even suggest, a metal phase construction that also includes "at least one phase selected from the group consisting of a  $\gamma$  phase, a  $\kappa$  phase, and a  $\mu$  phase" as recited in claims 1-14 of the present invention.

Other differences between the teachings of JP'429 and the presently claimed invention are as follows. JP'429 teaches that Si is added for the purpose of forming intermetallic compounds with Mn. The reference teaches that the addition of Si in excess of

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3% lowers the workability of the alloy and is undesirable. On the other hand, the metal alloys in accordance with the present invention include about 2.5 to 4.5%, by weight, of silicon, which exceeds the 3% limit taught by JP'429. The presently claimed amounts of silicon are recited in order to encourage the formation of sufficient  $\gamma$  phase to secure industrially satisfactory machinability (See above-captioned specification, page 5, lines 7-11).

JP'429 also teaches, in examples 7-23 of Table 1, that the amount of Mn added to the alloy must greatly exceed the amount of Si because the Mn is consumed by Si in order to produce the Mn-Si intermetallic compounds. JP'429, Table 1. Good machinability of such prior art alloys cannot be obtained without the addition of lead. According to the Cu-Zn(Pb) alloy recited in claim 7 of the present invention, when Si, Mn and Ni are included in the composition, it is required that the ratio of Si/Mn must not be less than 0.7. On the other hand, the examples shown in Table 1 of the JP'429 Document teach that the ratio of Si/Mn is not more than 0.68. These differences in the Si/Mn ratio are significant. There is no overlap of these ranges between the claimed invention and the prior art.

#### The JP'733 Document

JP'733 teaches a "manufacture of copper alloy and copper alloy material for radiator plate," which is a Cu-Zn-Sn alloy that can form cold rolled sheets. The copper alloy material taught by JP'733 necessarily includes tin. As discussed above, tin is not an element of claims 1-11, and the addition of tin would materially affect the basic and novel characteristics of the compositions recited in claims 1-11. Herz, 190 U.S.P.Q. at 463. See Table 9 of the instant application, and paragraphs 31 to 33 of the Oishi Decl.

In addition, only Example 13 in Table 1 of JP'733 even includes Pb, whereas each



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claim 1-14 in accordance with the present invention requires "0.02 to 0.4 percent, by weight, of lead." The JP'733 alloy of Example 13 contains only 0.01% Pb, which is a trace amount falling outside the amount of lead claimed in the present invention. Therefore, JP'733 does not teach, or even suggest, a free-cutting copper alloy that includes "0.02 to 0.4 percent, by weight, of lead" as recited in claims 1-14.

JP'733 also does not teach, or even suggest, that the total phase area comprises "not more than 5% of a  $\beta$  phase" as recited in claims 1-14. In fact, JP'733 is completely silent regarding metal phase construction; therefore, this reference also does not teach, or even suggest, the metal phase construction that includes "at least one phase selected from the group consisting of a  $\gamma$  phase, a  $\kappa$  phase, and a  $\mu$  phase" as recited in claims 1-14.

Some other differences include that JP'733 teaches silicon as an elective element ranging between 0.1% to 3%, although the maximum silicon content in the examples of JP'733, Table 1, is 1%. Also, those skilled in the art would realize that all of the alloys of Table 1 would manifest a metal phase construction that is solely made up of the  $\alpha$  phase, which would have extremely low machinability.

#### The Singh Patent

The Singh Patent teaches "plumbing fixtures and fittings employing copper-bismuth casting alloys" having an extremely wide range of compositions. Copper, misch metal and bismuth are all required elements (See Singh Patent, col. 3, Table). In preferred embodiments, tin, zinc and nickel are also required elements (Singh Patent, col. 4, lines 17-22). Silicon, on the other hand, appears to be an elective element (See Singh Patent, col. 3, Table). In these respects, the metal alloys taught by the Singh Patent appear fundamentally different from the Cu-Zn(Pb) alloys of the present invention.

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The Singh Patent cannot teach free-cutting copper alloys in accordance with the present invention because the Singh Patent teaches metal alloys that always include misch metal and bismuth. The misch metal is added to refine the grain and to improve the uniform distribution of bismuth, and lubricity throughout the metal alloy (Singh Patent, col. 2, lines 55-65). As shown in Figures 1 to 3 of the Singh Patent, such a uniform lubricious Cu-Bi metal alloy would have a uniform  $\alpha$  phase matrix. As taught in Figures 4 to 6 of the Singh Patent, the addition of both bismuth and misch metal to a Cu-Zn metal alloy materially alters the grain structure of the alloy (Singh Patent, col. 7, line 60 to col. 8, line 9).

The combination of misch metal and bismuth is not an element of the claimed invention as recited in claims 1-11. The Singh Patent teaches that the addition of both misch metal and bismuth would materially affect the basic and novel grain structure and phase characteristics of Cu-Zn compositions such as those recited in claims 1-11. Herz, 190 U.S.P.Q. at 463. Therefore, the scope of claims 1-11 would reasonably exclude the combination of bismuth and misch metal from the claimed metal composition.

Another significant deficiency of the Singh Patent is that it cannot teach a metal alloy composition having the total phase area comprised of "not more than 5% of a  $\beta$  phase" with the metal phase construction including "at least one phase selected from the group consisting of a  $\gamma$  phase, a  $\kappa$  phase, and a  $\mu$  phase" as recited in claims 1-14. In fact, the Singh Patent teaches copper-bismuth-misch metal alloys having a metal phase construction comprised solely of the  $\alpha$  phase as shown in Figures 1 to 6. Bismuth tends to form coarse granules as shown in Figures 1 and 2, and tends to make metal alloys brittle (Singh Patent, col. 2, lines 6-17). Figures 4 to 6 show that the addition of misch metal only makes the

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bismuth crystalline granules small. There is no evidence that  $\beta$ ,  $\gamma$ ,  $\kappa$ , or  $\mu$  phases are present in the copper-bismuth-misch metal alloys taught by the Singh Patent.

Those skilled in the art would realize that the Singh Patent teaches adding misch metal in order to provide Cu-Bi alloys with good machinability. Specifically, bismuth is relatively insoluble and does not form a solid solution in the copper alloys. Instead, bismuth precipitates as pure globules, and is similar to lead in this regard (Singh Patent, col. 1, lines 21-28, and col. 2, lines 11-17). The addition of misch metal keeps the crystalline construction of bismuth minute and fine. On the other hand, the present invention does not substitute one crystalline forming element for another, as is the technique used by Singh to achieve improved machinability. The present invention improves machinability of the alloy through a completely different mechanism, which is by manipulating the formation of various phases in the metal phase construction.

#### The WO'105 Document

WO'105 teaches a "copper alloy for electronic devices" that pertains to a field unrelated to the field of making alloys for manufacturing water faucets, water supply/drainage metal fittings and valves, and other similar components of water supply lines. There is no reason to believe that the copper alloys provided by WO'105 would be useful for these purposes. The relevance of this fact is that WO'105 teaches copper alloys having poor machinability, and not free-cutting copper alloys made in accordance with the present invention.

Specifically, WO'105 teaches Cu-Zn alloys that must include copper and zinc (See WO'105, Abstract). Silicon is an elective element, whose content is limited to 3% maximum by weight, although the examples include only up to 1.5% silicon by weight. In

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addition, tin appears to be included in the preferred embodiments taught by WO'105 (See WO'105, Abstract). Lead appears to be an optional element in the metal alloys taught by WO'105 (See WO'105, Abstract). In these respects, the Cu-Zn metal alloys taught by WO'105 appear fundamentally different from the Cu-Zn(Pb) alloys of the present invention because the WO'105 Document teaches Cu-Zn metal alloys that include tin, generally do not contain Pb, and include lower amounts of silicon than the 2.0 to 4.0 percent, by weight, of silicon recited in the present claims.

Another significant deficiency of WO'105 is that it cannot teach a metal alloy composition having the total phase area comprised of "not more than 5% of a  $\beta$  phase" with the metal phase construction including "at least one phase selected from the group consisting of a  $\gamma$  phase, a  $\kappa$  phase, and a  $\mu$  phase" as recited in claims 1-14. All of the alloys shown in the examples of WO'105 would have a single phase (i.e., an  $\alpha$  phase). There is nothing in the reference to teach, or even to suggest, that  $\beta$ ,  $\gamma$ ,  $\kappa$ , or  $\mu$  phases are present in the copper-zinc metal alloys taught by WO'105. As a result, WO'105 teaches only alloys with poor machinability, and not free-cutting copper alloys in accordance with claims 1-14 of the present application.

#### The JP'036 Document

JP'036 teaches a "copper alloy having superior wear and corrosion resistance" wherein the copper alloy consists of copper, zinc, phosphorous, tin, aluminum, manganese and silicon and is usable for mechanical parts and hydraulic parts (See JP'036, Abstract, and Table I, samples 7-23). The teachings of JP'036 are similar to those of the teachings

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of JP'429, except that the alloys of JP'036 generally do not include lead. Only sample 17 in the JP'036 document is shown to contain lead, which is in an amount of 0.1% by weight.

It is noted that JP'429, which shares a common inventor with JP'036, refers to the JP'036 document. Specifically, JP'429 mentions that the higher Pb contents of the Cu-Zn-Sn-Pb samples in Table 1 of the JP'429 reference have superior machinability to the alloys disclosed in the JP'036 reference. Because JP'429 teaches that the Cu-Zn-Sn-Pb alloys taught therein did not have acceptable machinability until lead content was 1.0% by weight, the Cu-Zn-Sn(Pb) alloy (i.e., sample 17) taught by JP'036 does not have good machinability by the author's own admission.

The Cu-Zn-Sn(Pb) alloy shown in sample 17 of Table 1 of JP'036 includes lead, but at a percentage by weight of only 0.1%. Based upon the similarities between sample 13 in the JP'429 document and sample 17 of the JP'036 document, and the teachings of JP'429 regarding the improved machinability characteristics of the metal alloys in the JP'429 reference over the alloys of the JP'036 reference, the machinability of sample 13 is not good based on the author's own admission.

Thus, on the basis of the combined teachings of the JP'429 and JP'036 references, it is unlikely that a person of ordinary skill in the art could arrive at the free-cutting copper alloys of claims 1-14 from the teachings of JP'429 and JP'036.

In the present application, none of claims 1-11 recite tin as an ingredient. Tin would materially affect the basic and novel characteristics of impact resistance, and probably also machinability, condition of chippings produced, and corrosion resistance, of the Cu-Zn(Pb) alloys recited in claims 1-11. See Table 9 of the present application, and paragraphs 31 to 33 of the Oishi Decl.

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The teachings of the JP'036 document share many of the same deficiencies as those of the JP'429 document. Specifically, neither reference teaches, nor suggests, the critical nature of the metal phase construction recited in claims 1-14. Each of claims 1-14 recite that the total phase area comprises "not more than 5% of a  $\beta$  phase," which is a critical limitation of metal phase construction as supported by the attached Oishi Decl.

The various constraints on the metal compositions of the metal alloys recited in claims 1-14 relates to preserving the claimed limitation that the percentage of  $\beta$  phase must not exceed the specified amount. The only Cu-Zn(Pb) alloy taught by JP'036 is Example 17 in Table 1, which has a Zn content of 35% by weight so the Cu content must be less than 65% by weight. JP'036 is completely silent regarding metal phase construction; however, Samples Nos. 5, 6 and Comparative Sample No. 7 of Table I of the Oishi Decl. suggest that as copper content drops below 69% by weight, an excessive amount of  $\beta$  phase is formed. Therefore, from the data in Table I of the Oishi Decl. and from the Zn content of 35% by weight taught by Example 17 of the JP'036 document, one can reasonably infer that, in view of the relatively low Cu content and relatively high Zn content of Example 17, there is a low likelihood that JP'036 teaches a Cu-Zn(Pb) alloy having the claimed metal phase construction. In other words, JP'036 also does not teach, or even suggest, the metal phase construction that includes "not more than 5% of a  $\beta$  phase" and "at least one phase selected from the group consisting of a  $\gamma$  phase, a  $\kappa$  phase, and a  $\mu$  phase" as recited in claims 1-14.

#### **Deficiencies of the Examiner's 103 Rejection**

In view of the multiple and severe deficiencies of the teachings of the prior art references discussed above, it appears the Examiner has not established even a prima facie showing of obviousness against the claims of the present invention. Rather, it appears the

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Examiner focused on the "gist" of the invention, which the Federal Circuit has ruled is improper. Vas-Cath, Inc. v. Mahurkar, 19 U.S.P.Q.2d 1111, 1118 (Fed. Cir. 1991).

Specifically, the prior art of record fails to teach, or even suggest, the metal phase construction recited in claims 1-14 of the present invention. The prior art can be succinctly summarized as follows:

(a) The Nakashima Patent, the closest prior art, focuses on copper-zinc metal alloys that are very hard and have poor machinability. Nakashima teaches one Cu-Zn(Pb) alloy as Example D in Table 1 of the Nakashima Patent. However, Nakashima's Cu-Zn(Pb) alloy has a Hardness Rockwell B value of 95 and a metal phase construction that comprises solely a  $\beta$  phase as described in Nakashima, Table 1. The 100%  $\beta$  phase construction of Nakashima's Example D alloy, which corresponds to Comparative Sample No. 4 of Table I of the Oishi Decl., is very different from the alloys of the present invention, which require a metal phase construction comprising "not more than 5% of a  $\beta$  phase, and 5-70% of the total phase area is provided by at least one phase selected from the group consisting of a  $\gamma$  phase, a  $\kappa$  phase, and a  $\mu$  phase" as recited in claims 1-14.

(b) JP'429 teaches a Cu-Zn-Sn-Pb alloy that contains too much lead, and does not teach a free-cutting copper alloy having "0.02 to 0.4%, by weight, of lead" and a metal phase construction comprising "not more than 5% of a  $\beta$  phase, and 5-70% of the total phase area is provided by at least one phase selected from the group consisting of a  $\gamma$  phase, a  $\kappa$  phase, and a  $\mu$  phase" as recited in claims 1-14.

(c) JP'733 teaches Cu-Zn-Sn alloys, and in Example 13 a trace of Pb (i.e., 0.01% of lead) is added. However, JP'733 does not teach a free-cutting copper alloy having "0.02 to 0.4%, by weight, of lead" and a metal phase construction comprising "not more than 5% of a  $\beta$  phase, and 5-70% of the total phase area is provided by at least one phase selected from the

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group consisting of a  $\gamma$  phase, a  $\kappa$  phase, and a  $\mu$  phase" as recited in claims 1-14.

(d) The Singh Patent teaches Cu-Bi-misch metal alloys having a metal phase construction consisting of only an  $\alpha$  phase as shown in Figures 1 to 3. Therefore, the Singh Patent cannot teach, or even suggest, a free-cutting copper alloy having a metal phase construction comprising "not more than 5% of a  $\beta$  phase, and 5-70% of the total phase area is provided by at least one phase selected from the group consisting of a  $\gamma$  phase, a  $\kappa$  phase, and a  $\mu$  phase" as recited in claims 1-14.

(e) WO'105 teaches various Cu-Zn alloys with various other elements added. The alloys shown in all of the examples of WO'105 would have a single  $\alpha$  phase. WO'105 does not teach, or even suggest, a free-cutting copper alloy having a metal phase construction comprising "not more than 5% of a  $\beta$  phase, and 5-70% of the total phase area is provided by at least one phase selected from the group consisting of a  $\gamma$  phase, a  $\kappa$  phase, and a  $\mu$  phase" as recited in claims 1-14.

(f) JP'036 teaches Cu-Zn-Sn alloys that include multiple other elements as well. JP'036 teaches only one Cu-Zn-Sn(Pb) alloy in Example 17, and this alloy has such a high Zn content that it cannot have "69 to 79 percent, by weight, of copper" as recited in claims 1-14. Furthermore, JP'036 is completely silent with respect metal phase construction and the Cu-Zn-Sn(Pb) alloy of Example 17, having an insufficient amount of Cu, is unlikely to have a metal phase construction with "not more than 5% of a  $\beta$  phase, and 5-70% of the total phase area is provided by at least one phase selected from the group consisting of a  $\gamma$  phase, a  $\kappa$  phase, and a  $\mu$  phase" as recited in claims 1-14.

Clearly, none of the prior art references teaches, or even suggests, a free-cutting copper alloy in accordance with the present invention that has "not more than 5% of a  $\beta$  phase, and 5-70% of the total phase area is provided by at least one phase selected from the



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group consisting of a  $\gamma$  phase, a  $\kappa$  phase, and a  $\mu$  phase" as recited in claims 1-14. Therefore, the Examiner has failed to establish a *prima facie* case of obviousness because the scope and content of the prior art does not teach, or even suggest, the claimed metal phase construction of the Cu-Zn(Pb) alloy of the present invention.

The Examiner argues that "[s]ince the instant Cu-Zn alloy compositions are overlapped by the cited references...the phases distribution as recited in the instant claims would have [been] inherently possessed by the teachings of the cited references" and cited *In re Spada*, 15 U.S.P.Q.2d 1655, 1658 (Fed. Cir. 1990) and *In re Best*, 195 U.S.P.Q. 430, 433 (C.C.P.A. 1977) in support of this position (Office Action, dated October 9, 2003, page 4, lines 4-11). However, the references themselves do not support the inherency argument factually, and the caselaw also does not support the inferences as a matter of law.

Specifically, in *Spada*, the court ruled that discovery of a new property for a polymer anticipated by the prior art U.S. Patent to Smith did not overcome anticipation under 35 U.S.C. § 102. *Spada*, 15 U.S.P.Q.2d at 1658. However, in the present circumstance, no *prima facie* case of anticipation under 35 U.S.C. § 102 stands against the present claims. In addition, metal phase construction is a structure and state, not a property. As evident from Exhibits A to D provided in support of the Oishi Declaration, metal phase defines the physical structure of the metal composition. Metal phase state is not a "property." It is a structure or state and is specifically claimed. Therefore, *Spada* does not apply.

In *Best*, the court held that the prior art U.S. Patent to Hansford taught all of the claimed features of a process for producing hydrothermally stable zeolite compositions except for the "expressed rate of cooling." *Best*, 195 U.S.P.Q. at 432. The court ruled that inherent to the Hansford Patent was the presumption that a rate of cooling typically used in the laboratory would produce the zeolite composition, and that the inventor could have

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overcome this presumption of inherency by showing that typical rates of cooling did not produce the desired zeolite composition. *Best*, 195 U.S.P.Q. at 432-3.

The caselaw established in *Best* does not apply to the present case because the Nakashima Patent does not teach the compositions and metal phase constructions recited by claims 1-14 of the present invention. Specifically, only Example D in Table 1 of the Nakashima Patent is even a Cu-Zn(Pb) alloy, and it has a metal phase construction consisting solely of  $\beta$  phase as described in Table 1 of the Nakashima Patent, and as confirmed by the data compiled in the Oishi Decl. (See Table I on page 19, Comparative Sample No. 4).

More generally, the applicable standard for inherency is that it must flow as the natural result of the teachings of the reference. Inherency cannot be established by mere probability or possibility alone. *Continental Can Co. USA Inc. v. Monsanto Co.*, 20 U.S.P.Q.2d 1746, 1749 (Fed. Cir. 1991). In view of this standard, it is noted that the Nakashima Patent explicitly teaches a Cu-Zn(Pb) alloy that does not have the metal phase construction as required by claims 1-14 of the present invention. In addition, the Singh Patent teaches Cu-Bi-misch metal alloys having solely an  $\alpha$  phase construction. Similarly, Comparative Samples Nos. 1, 2, 3, 4, 7, 8.1, 8.2 and 9.1 listed in Table I on page 19 of the Oishi Decl. all demonstrate that Cu-Zn(Pb) alloys do not inherently have the metal phase construction recited in claims 1-14 of the present invention. In view of these facts, some derived directly from the prior art and some ascertained by experiment, it is established that Cu-Zn(Pb) alloys having compositions overlapping those of claims 1-14 do not inherently have the claimed metal phase construction.



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No. 18 of the Oishi Declaration). However, Comparative Sample No. 9.1, formed by hot extrusion of a Cu-Zn(Pb) ingot having the same metal composition as Sample No. 6 and Comparative Sample No. 9.2, is not a metal alloy in accordance with the present invention because it includes 10%  $\beta$  phase. As shown in Table I of the Oishi Decl., Comparative Sample No. 9.1 requires a greater cutting force, has an unacceptably poor resistance to corrosion, and produces the undesirable spiral arc cuttings when machined. On the other hand, Sample No. 6 and Comparative Sample No. 9.2 are Cu-Zn(Pb) alloys made in accordance with the present invention and these alloys manifest lower required cutting forces, have significantly better corrosion resistance than Comparative Sample No. 9.1, and produce the desired cuttings when machined.

Third, metal alloy Samples Nos. 5 and 6, which represent the present invention, were significantly superior to Comparative Samples Nos. 1 to 4, which represent or approximate the metal alloys of the Nakashima Patent, as shown by the comparative data in Table I on page 19 of the Oishi Decl. Specifically, Samples Nos. 5 and 6 required substantially less cutting force than the hard alloys of Comparative Samples Nos. 1 to 4, by a factor of almost 2. In addition, the cutting tests showed that only Samples Nos. 5 and 6 produced the desired metal cuttings when machined, whereas Comparative Samples Nos. 1 to 4 produced spiral winding cuttings that are not easy to recycle and that can damage the cutting tool.

### **Conclusion**

The rejection under 35 U.S.C. § 103 is untenable and must be withdrawn because none of the six prior art references teach, or suggest, either alone or in combination with each other, a free-cutting copper alloy that includes "not more than 5% of a  $\beta$  phase, and 5-

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70% of the total phase area is provided by at least one phase selected from the group consisting of a  $\gamma$  phase, a  $\kappa$  phase, and a  $\mu$  phase" as recited in claims 1-14. In addition, Applicant has shown that the prior art of record, and experimental evidence filed with the Oishi Decl., establish that the claimed metal phase construction is not inherent to Cu-Zn(Pb) alloys in general, but is a feature of the Cu-Zn(Pb) alloys made in accordance with the present invention. Lastly, Applicant has provided experimental evidence that shows (a) the criticality of copper and zinc content on  $\beta$  phase formation, (b) the relationship between hot extrusion temperature and  $\beta$  phase formation, and (c) the superior and unexpected improvements in required cutting force and the condition of cuttings produced during cutting of Cu-Zn(Pb) alloys of the present invention over the Cu-Zn(Pb) alloy taught by the Nakashima Patent, and comparative samples even closer to the present invention than the Nakashima Patent.

For the above reasons, the rejections of record should be reconsidered and withdrawn and the claims allowed.

Questions are welcomed by the below signed attorney for the Applicant.

Respectfully submitted,

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